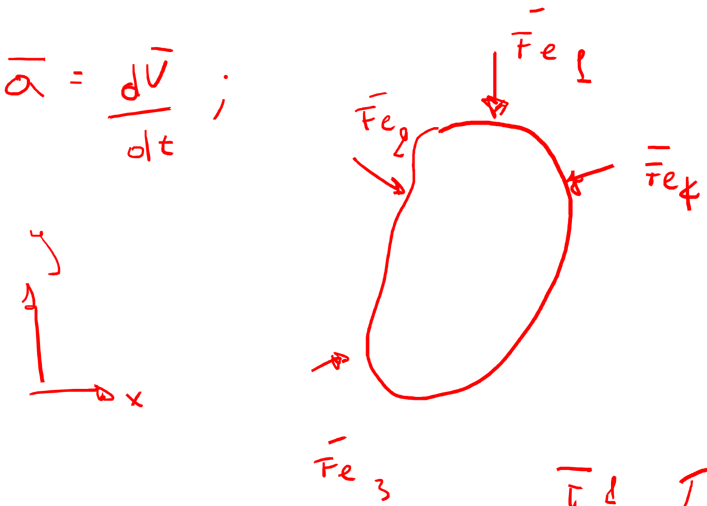
• Dinamica $\Rightarrow$ Statica

$$\bar V = \frac{d\bar x}{dt} \quad ; \qquad \text{vettore posizione}$$

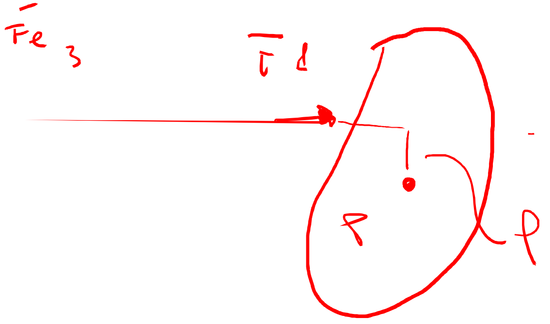
$$m\,\underbrace{\frac{d\bar V}{dt}}_{}^{\bar a} = \bar F \Rightarrow \quad \bar F = m\bar a$$

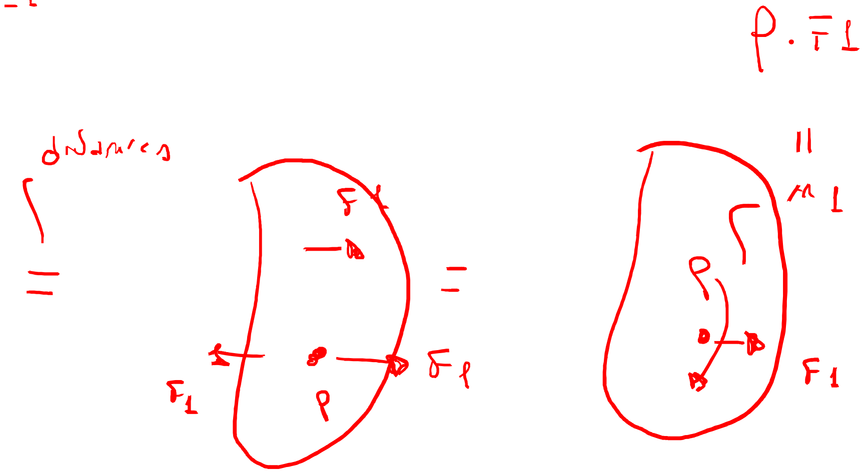
$$\bar a = \frac{d\bar V}{dt} \quad ;$$



• Equilibrio

$$\sum_{i=1}^{n} \bar F_{e_i} = 0 \quad + \quad \sum_{i=1}^{n} \bar M_i = 0$$





$$\sum_{i}^{n} \bar{F}_{i_e} = 0 \quad (1) \qquad , \qquad \sum_{i}^{n} \bar{M}_i = 0 \quad (2)$$

$\Rightarrow$ [Equilibrio di un corpo rigido]

3D $\rightarrow$

(1) $\rightarrow$

$$\sum_{i=1}^{n} \bar{F}_x = 0$$

$$\sum_{i=1}^{n} F_y = 0$$

$$\sum_{i=1}^{n} \bar{F}_z = 0$$

(2)

$$\sum_{i=1}^{n} M_x = 0$$

$$\sum_{i=1}^{n} M_y = 0$$

$$\sum_{i=1}^{n} M_z = 0$$

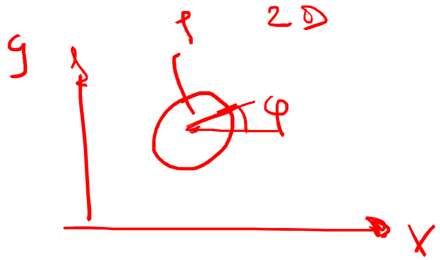
In Dinamica:

$$\begin{cases} \sum_{i=1}^{n} \bar{F}_{e_i} = m\,\bar{a}_{cm} \\ \dfrac{d\bar{L}_c}{dt} = \sum_{i=1}^{n} \bar{M}_i \end{cases}$$

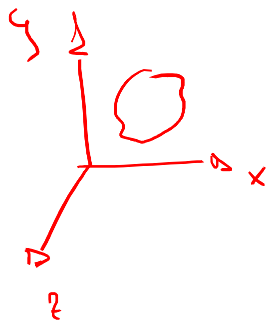
$$\begin{cases} \dfrac{d\bar{L}_c}{dt} = \dfrac{d}{dt}\,\bar{I}_{ij}\,\omega_j\,; \\ \sum_{i=1}^{n} \bar{M}_i = \varepsilon_{ijk}\,\bar{F}_{jk}^{(e)}\,; \end{cases}$$

$$\begin{bmatrix} L_{cx} \\ L_{cy} \\ L_{cz} \end{bmatrix} = \begin{bmatrix} I_{xx} & -I_{xy} & -I_{xz} \\ -I_{yx} & I_{yy} & -I_{yz} \\ -I_{zx} & -I_{zy} & I_{zz} \end{bmatrix} \begin{bmatrix} \omega_x \\ \omega_y \\ \omega_z \end{bmatrix}$$

→ gradi di libertà

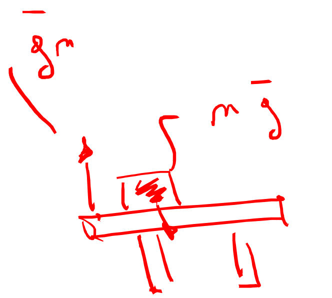


corpo in 2D HA 3 D.O.F.
→ 2 posizione del CM
→ 1 alla rotazione



corpo in 3D è caratterizzato da 6 D.O.F.
→ 3 posizione del CM
→ 3 individuano l'orientazione del corpo → 3 angoli di Eulero

• equilibrio → statica



Toglie

1 D.O.F.

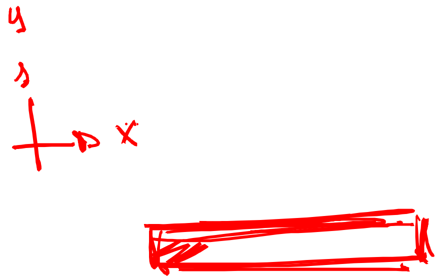
CARRELLO

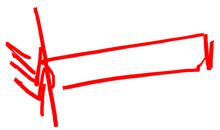
2 D.O.F.

CERNIERA

3 D.O.F.

INCASTRO





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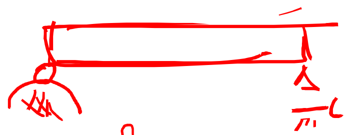
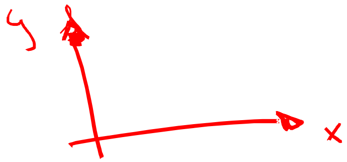
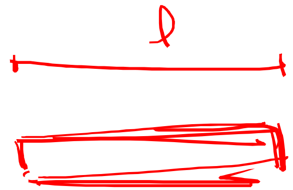
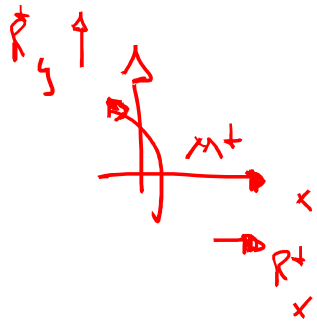


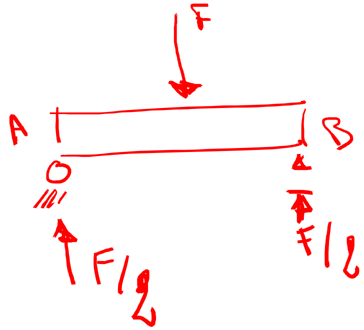
CERNIERA

CARRELLO









$X: \sum_{i=1}^{n} F_{i_x} = 0$

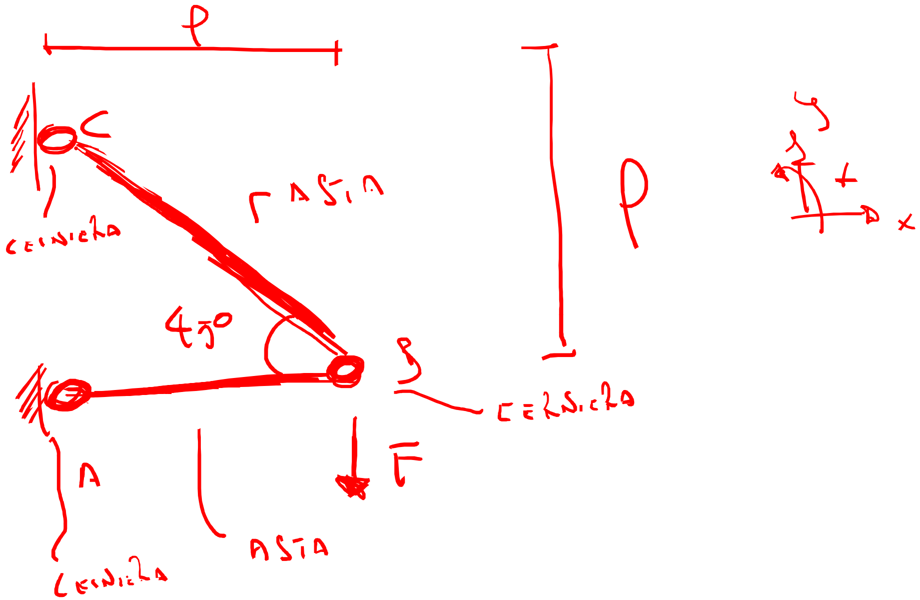
$y: \sum_{i=1}^{n} F_{i_y} = 0$

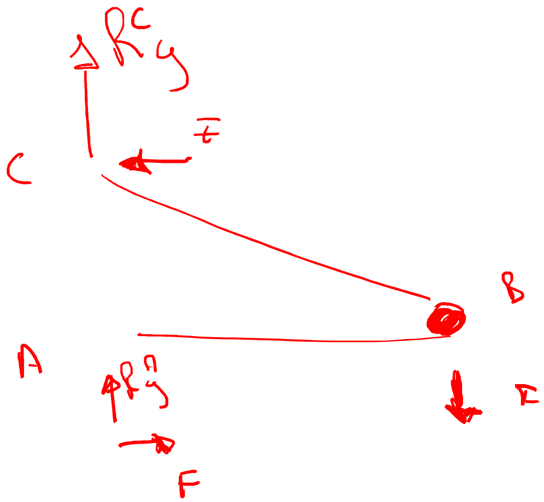
$O|_A: \sum M|_A = 0$

$X: R^A_x = 0$

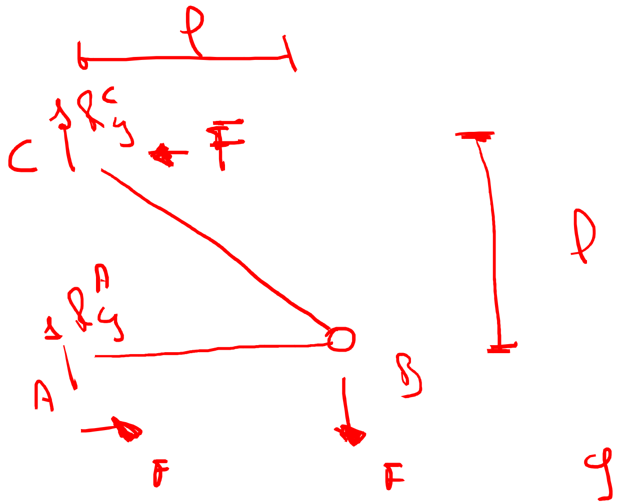
$y: R^A_y + R^B_y - F = 0$

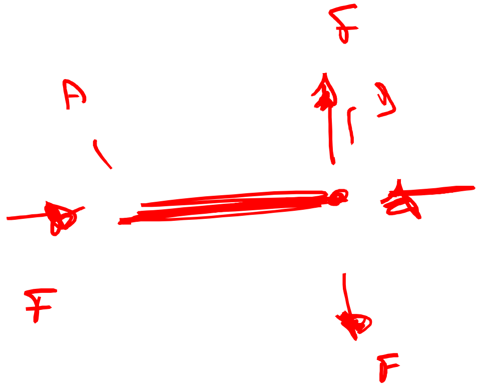
$$O|_A: -F\frac{l}{2} + R^B_y \cdot l = 0 \Rightarrow \begin{cases} R^A_x = 0 \\ R^A_y = F/2 \\ R^B_y = \frac{F}{2} \end{cases}$$





$$
\begin{cases}
x:\ R_x^A + R_x^C = 0 \\
y:\ R_y^A + R_y^C = F \\
\circlearrowleft\big|_C:\ -lF + l\,R_x^A = 0 \quad \Rightarrow R_x^A = F \\
x:\ R_x^C = -R_x^A = -F
\end{cases}
$$





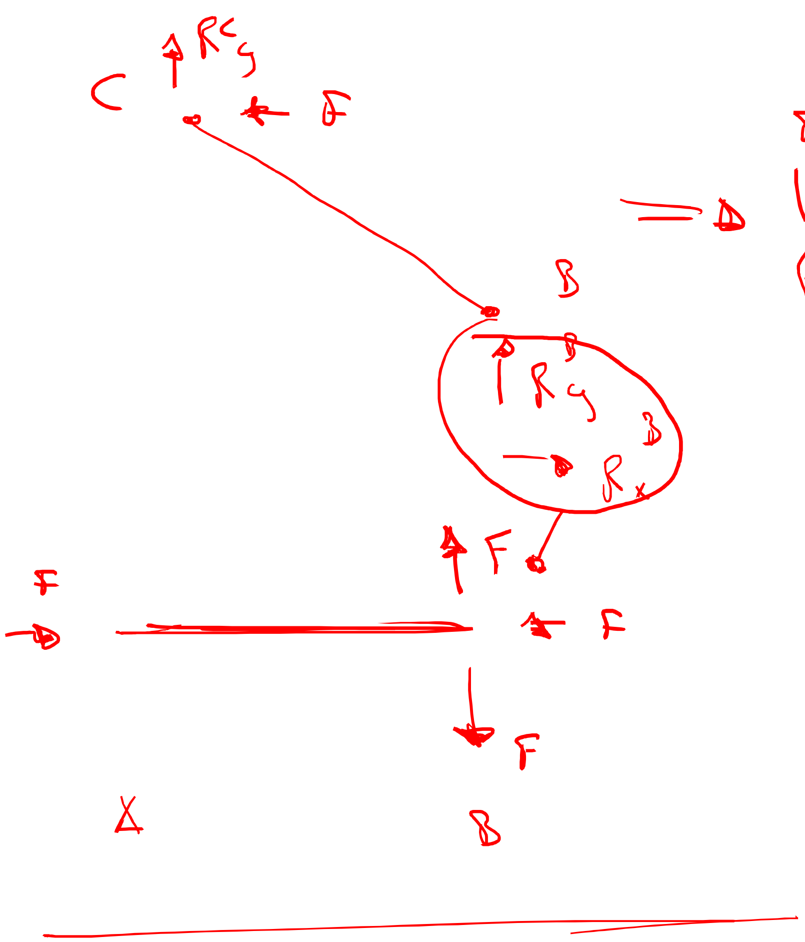
$$X: \; F + R_x^B = 0$$

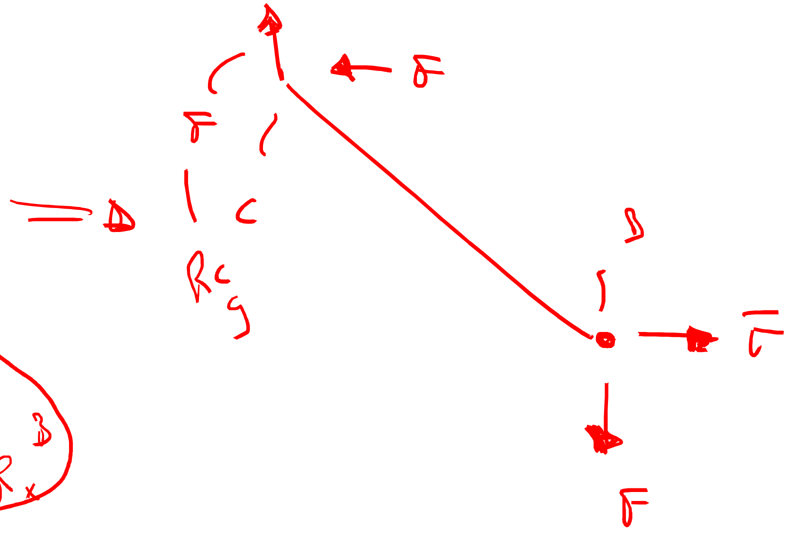
$$y: \; R_y^A + R_y^B = F$$

$$\circlearrowleft\big|_B : \; -\ell \cdot R_y^A = 0 \implies \boxed{R_y^A = 0}$$

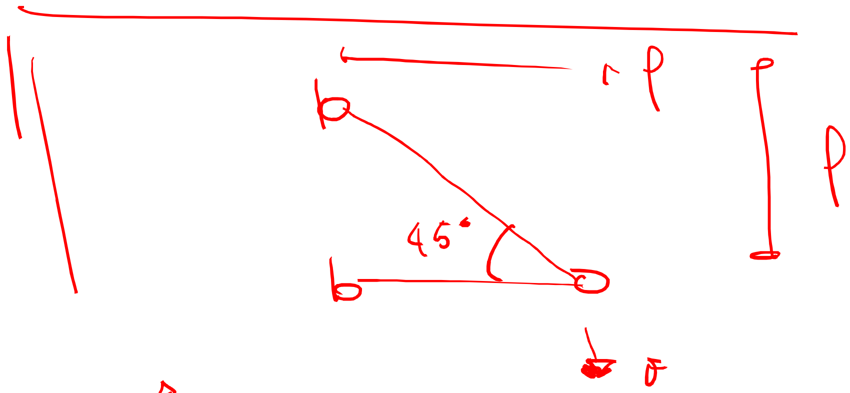
$$\implies y: \; \boxed{R_y^B = F}$$

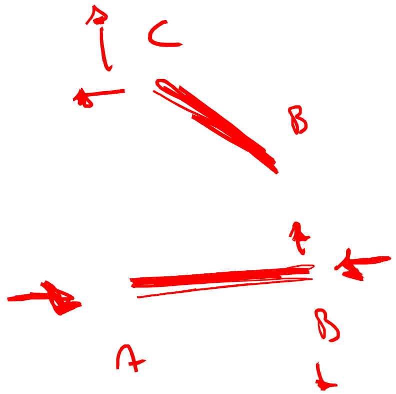
$$\implies X: \; \boxed{R_x^B = -F}$$

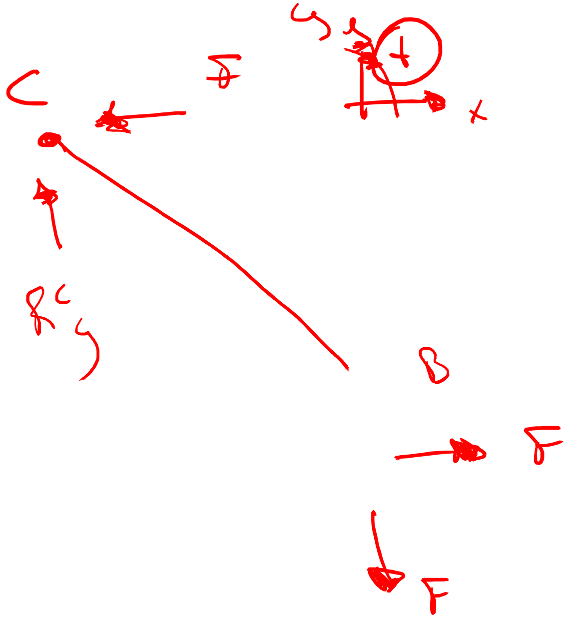




$R^C_y = F : y$



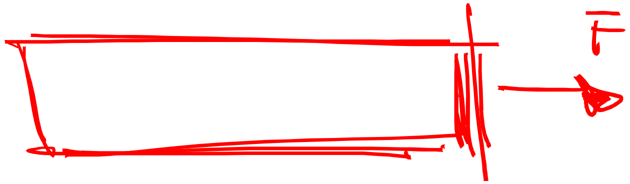




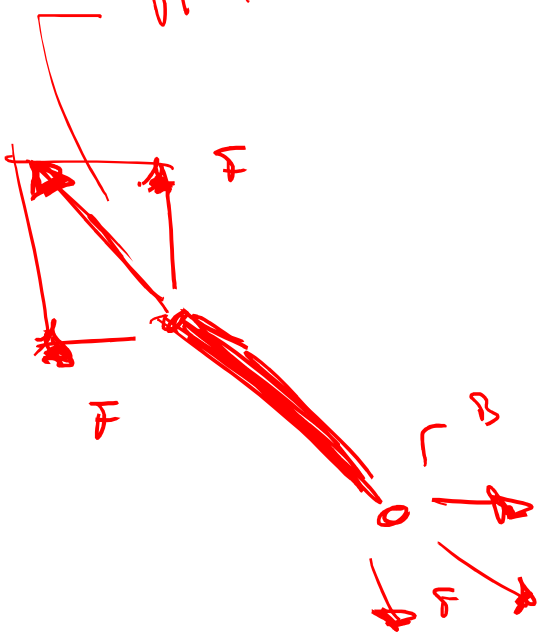
$$y: R_y^C = F$$

$$R_y^C - F = 0$$

$$\sqrt{F^2+F^2} = \sqrt{2}\,F$$

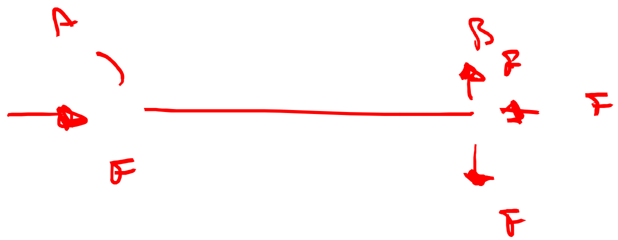


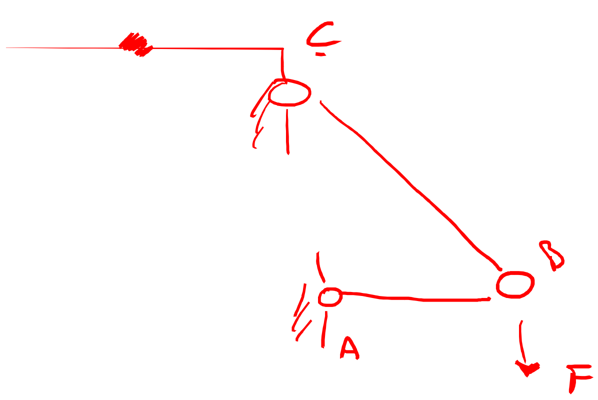
Sezione

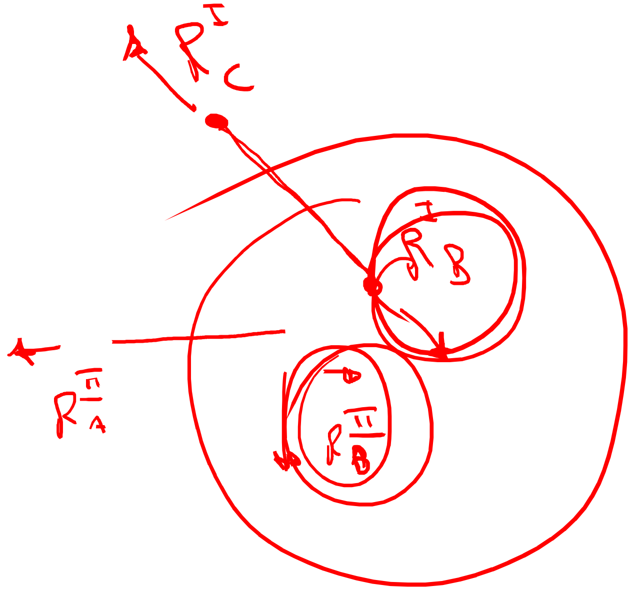


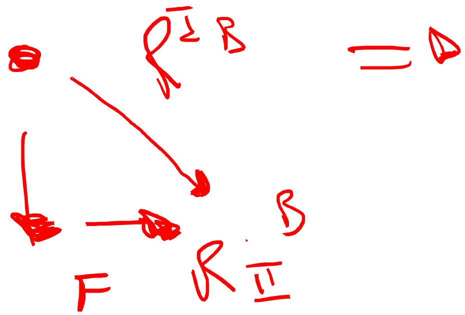
$\sim \sqrt{2}\,F$

Risultante



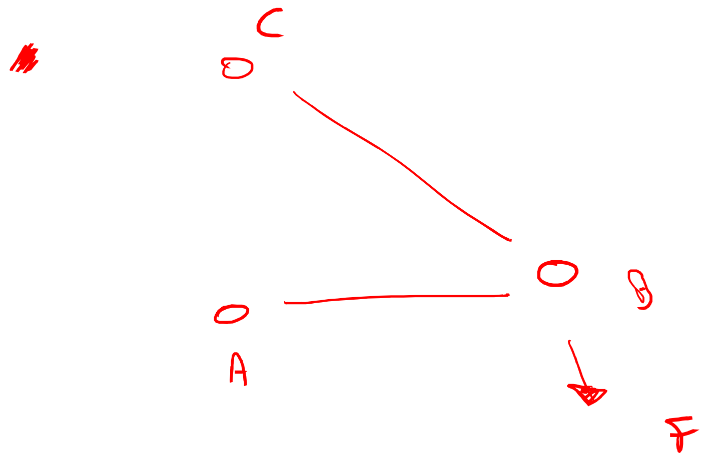


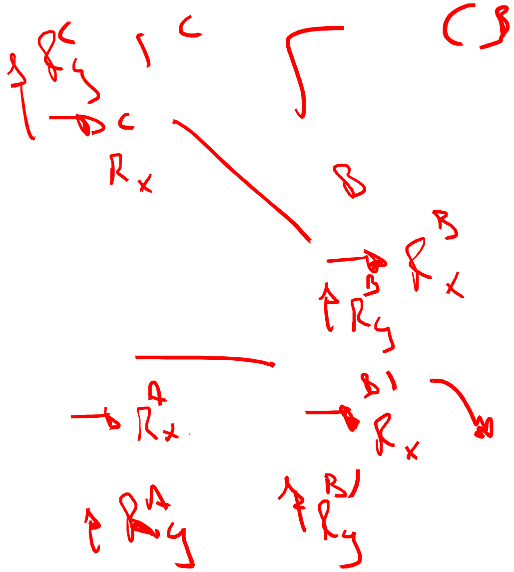




$R^{IB} = \sqrt{2} F$

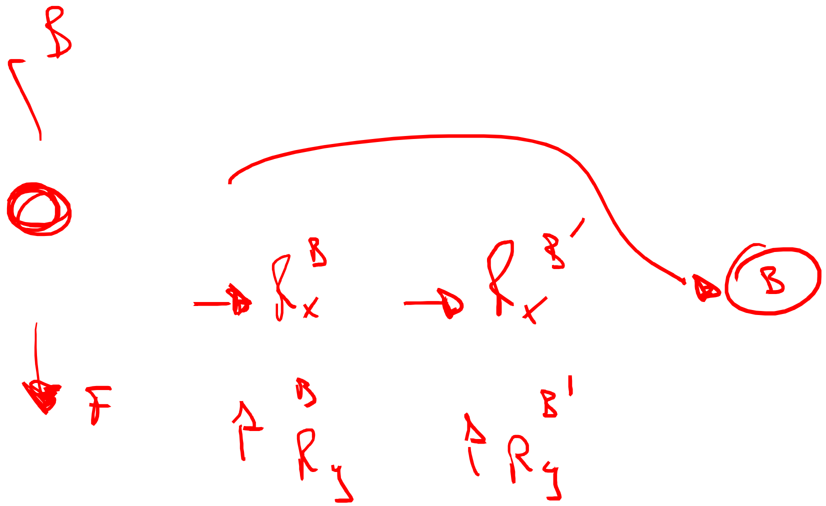
$2 R^{B}_{II} = -F$





CB → 3 equations

AB → 3 equations



B → 2 equations